

Benchmark studies in the new Nottingham ABL wind tunnel: section model tests

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Abstract

The University of Nottingham has recently built a new atmospheric boundary layer (ABL) wind tunnel. The tunnel has an open return section with a "blow down" configuration. It has a fetch of 12 m and a working section of 2.4 m by 1.8 m. The tunnel has been designed to have an operating speed of 0 - 15 m/s. Although it was designed primarily for simulating flows in the atmospheric boundary layer, it was intended to use the tunnel with roughness removed to perform section model tests on bridge decks etc. Therefore a series of tests have been performed on a 5:1 rectangular section to demonstrate the suitability of the tunnel for this kind of study.

- Measurement of force coefficients in the range $\pm 10^\circ$
- Measurement of dynamic response due to buffeting and vortex shedding
- Measurement of flutter derivatives

The section model was constructed from aluminium with a length of 1.8m and cross section dimensions 76mm by 380mm. The model was set up 2m downstream of the contraction and the flow at deck level had a turbulence intensity less than 1%. For the force coefficient measurements, the model was mounted on four two component load cells that allowed lift, moment and drag to be calculated. For the other tests, the deck was mounted on a set of eight springs tuned to allow the deck to heave and pitch at set frequencies.

The results agreed well with published data.